



Flood risk assessment through 1D/2D couple HEC-RAS hydrodynamic modeling- A case study of Surat City, Lower Tapi Basin, India

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Surat, known as the diamond city of Gujarat is situated 100 km downstream of Ukai dam and near the mouth of river Tapi and affected by the flood at every alternate year. The city experienced catastrophic floods in 1933, 1959, 1968, 1970, 1994, 1998 and 2006. It is estimated that a single flood event during August 6-12, 2006 in Surat and Hazira twin-city, caused heavy damages, resulted in the death of 300 people and property damage worth € 289 million. The peak discharge of 25768 m³ s⁻¹ release from Ukai dam was responsible for the disastrous flood in Surat city. To identify low lying areas prone to inundation and reduce the uncertainty in flood mitigation measures, HEC-RAS based 1D/2D Couple hydrodynamic modeling is carried out for Surat city. Release from the Ukai dam and tidal level of the sea are considered for upstream and downstream boundary condition. 299 surveyed cross-sections have been considered for 1D modeling, whereas a topographic map at 0.5 m contour interval was used to produce a 5 m grid and SRTM (30 & 90 m) grid has been considered for Surat and Lower Tapi Basin (LTB). Flow is simulated under unsteady conditions, calibrated for the year 1998 and validated for the year 2006. The simulated result shows that the 9th August 18.00 hr was the worst day for Surat city and maximum 75-77 % area was under inundation. Most of the flooded area experienced 0.25 m/s water velocity with the duration of 90 hr. Due to low velocity and high duration of the flood, a low lying area within the west zone and south-west zone of the city was badly affected by the flood, whereas the south zone and south-east zone was least. Simulated results show good correlation when compared with an observed flood level map. The simulated results will be helpful to improve the flood resilience strategy at Surat city and reduce the uncertainty for flood inundation mapping for future dam releases. The present case study shows the applicability of 1D/2D coupled hydrodynamic modeling for flood inundation mapping and can be applied for flood assessment at locations with similar geographical conditions.